S.It.E. - Società Italiana di Ecologia

The contribution of ecology to the "Ecological Transition" in the Mediterranean Sea

Roberto Danovaro

Polytechnic University of Marche

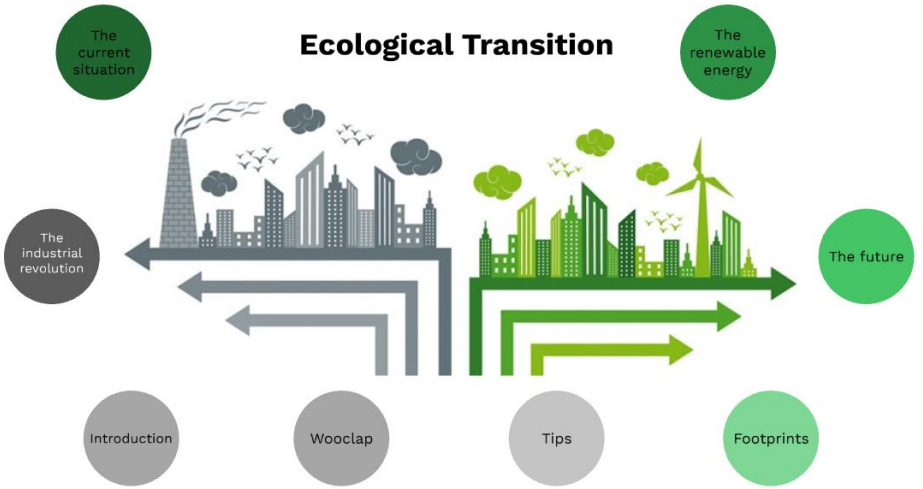
Ecological transition: what is it?

Ecological transition aims at changing our lives making them in harmony with Nature. To do so we need **new social and economic models** in order to respond intelligently to **ecological challenges**.

It aims to rethink the way we live and use our territory, our seas, the way we work and produce in order to reduce our **impact on ecosystems**.

In the long term, it will enable us to adopt a sustainable development approach, by favoring renewable energies, **modifying our consumption behavior** and limiting waste.

Its aim is to provide an economic and social response to the environmental challenges facing our planet.



EU Green Deal

Preserving and restoring ecosystems and biodiversity

"To deliver the European Green Deal, there is a ***need to rethink policies for clean energy supply across the economy, industry, production and consumption, large-scale infrastructure, transport, food and agriculture, construction, taxation and social benefits***.

To achieve these aims, it is essential to increase the value given

1) to protecting and restoring natural ecosystems,

2) to the sustainable use of resources and

3) to improving human health."

The grand environmental crisis

75%
of lands significantly altered, with negative impacts on the wellbeing of 3.2 billion of people

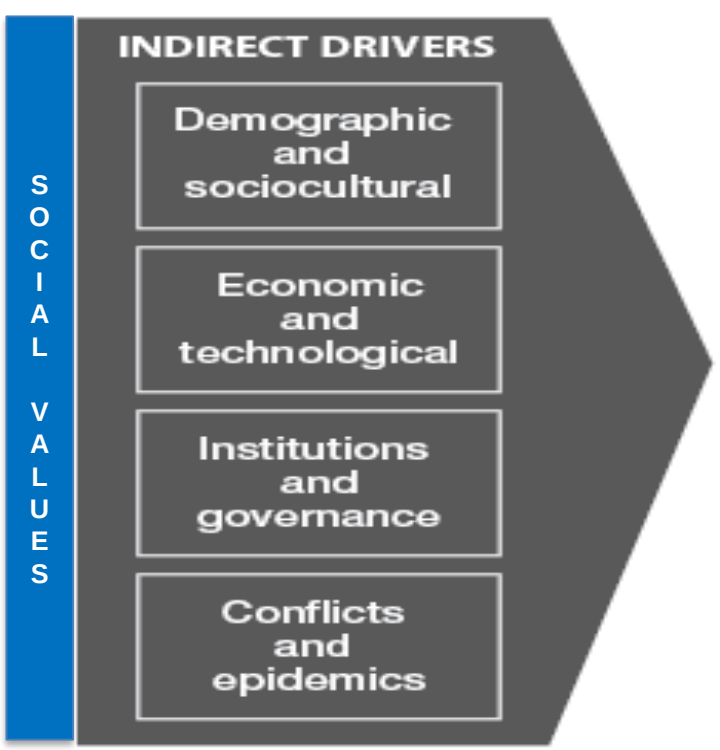
90%
of land altered by 2050

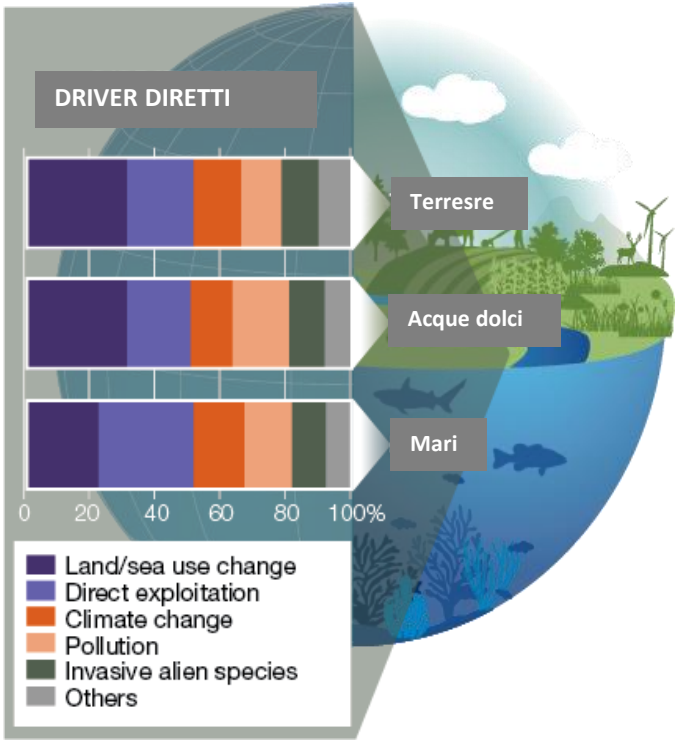
66%
Of the oceans exposed to growing cumulative impacts and only 3% is pristine

1 million species
(500,000 species of animals and plants and 500,000 species of insects) at risk of extinction on 2.5 millions (known) and 8.1 millions species possibly existing

>85%
of wetlands has been lost

Drivers of change in the last 50 years have reached unprecedented levels in the history of humanity





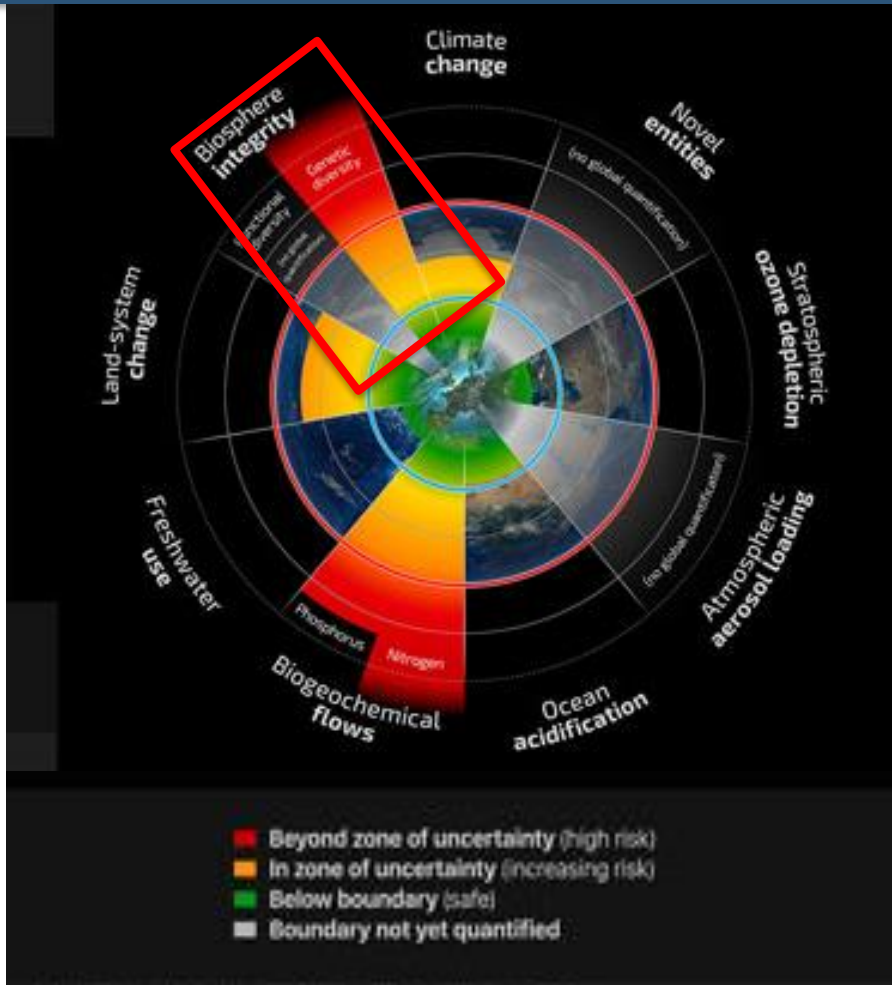
9 Planet Boundaries

Biosphere integrity
(either marine and terrestrial)

Biogeochemical flows
beyond the boundaries

Land use and **Climate change**
approaching the boundaries

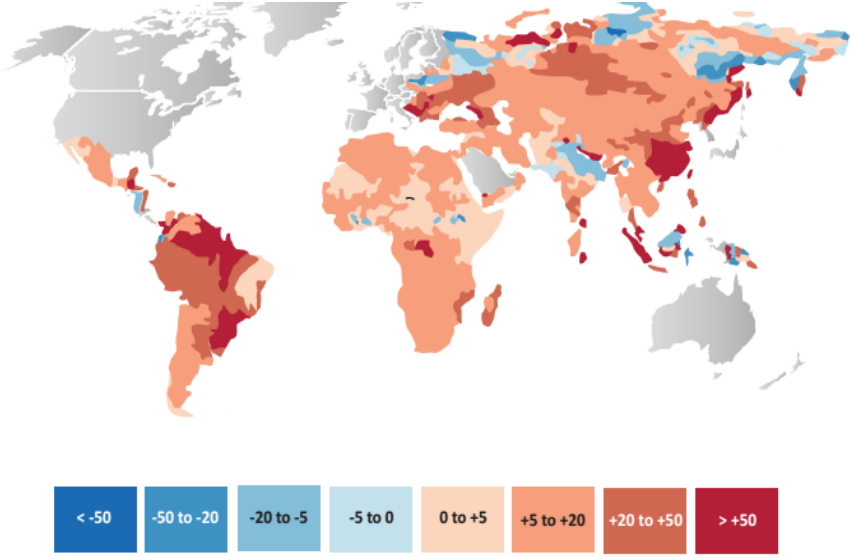
Stockholm Resilience Centre

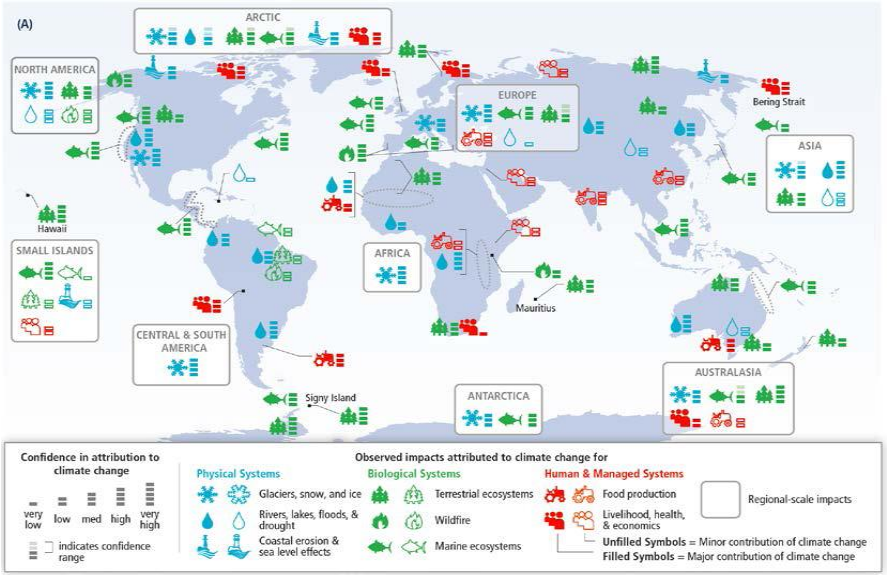


Climate Emergency

EU declares the Climate Emergency (2019)

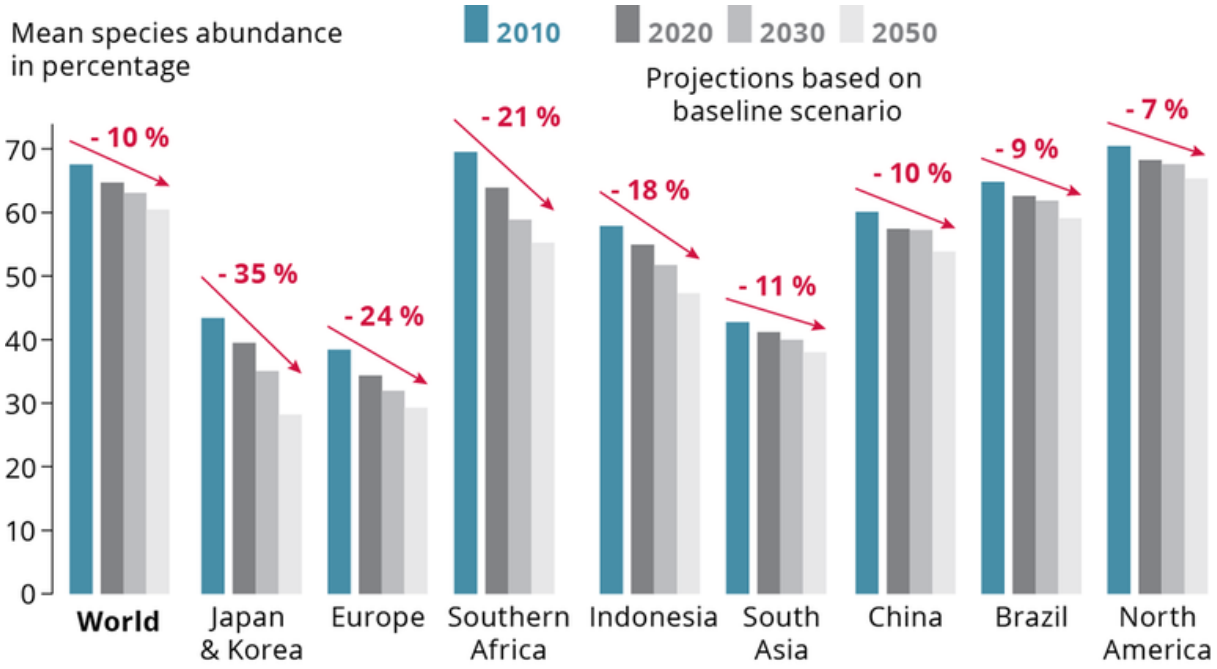
EU should commit to net-zero greenhouse gas emissions by 2050 at the UN Conference, says Parliament. *Ahead of the UN COP25 Climate Change Conference in Madrid 2-13 December, the Parliament on Thursday approved a resolution declaring a climate and environmental emergency in Europe and globally. They also want the Commission to ensure that all relevant legislative and budgetary proposals are fully aligned with the objective of limiting global warming to under 1.5 °C.*





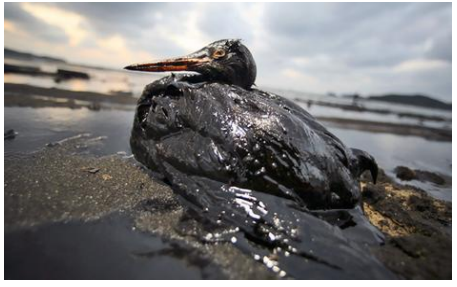
Biodiversity crisis

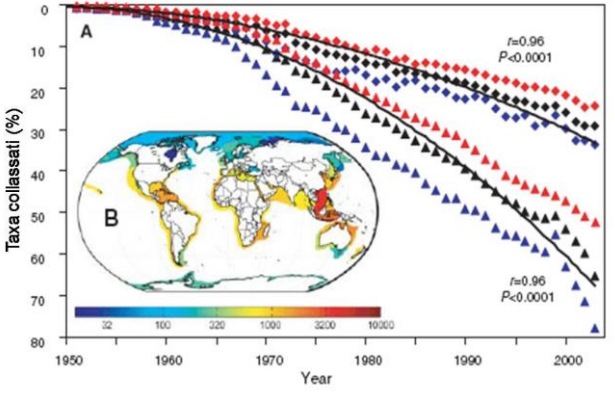
Extinction rates 100 - 1000 times higher than in the pre-anthropocene



Extinction rates linked to the land use, human population density and growth rate of the emerging economies

Collapse of natural populations and exploited species





Habitat degradation

Over recent decades to centuries, continued declines of coastal ecosystems have occurred globally such that the global coverage of **saltmarshes, mangroves, seagrasses, oyster reefs, kelp beds and coral reefs has been reduced by 35-85%.**

Such environmental degradation results in drastic declines in the value of marine ecosystem services and, subsequently, increasing costs to society.

Collapse of the Natural Capital

Marine forests are being lost at a rate 4 times higher that pluvial forests

We need to reduce the human impacts on Nature and protect pristine *habitats*

Habitat	Area	Natural capital	Loss (%)	Natural Capital Loss
	(ha)	Euro/ha/yr		(Mln Euro)
Cystoseira spp.	9600	287.4	84	1,509
Seagrass	337611	10107.9	25	3,369

Loss of goods and ecosystem services

DRINKABLE WATER
HEALTHY FOOD
CLEAN AIR

«resistance»
«restoration»
«resilience»
«complexity /holism»

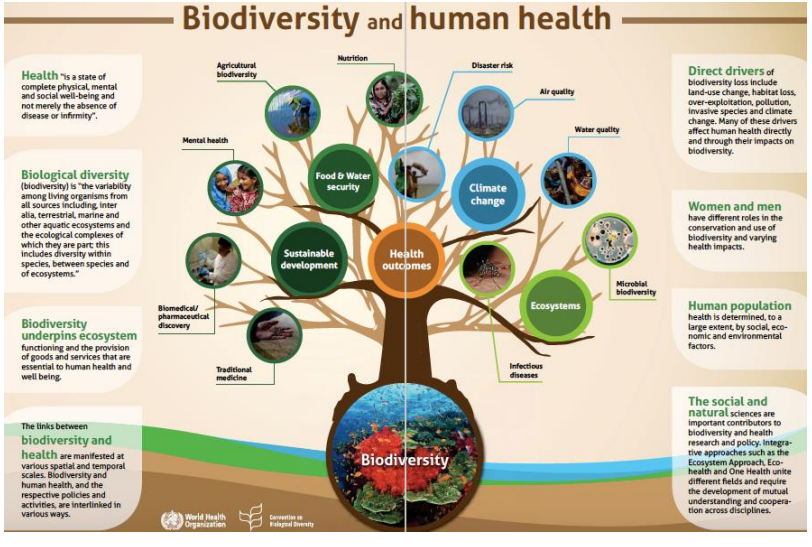
Collapse of Ecosystem Services

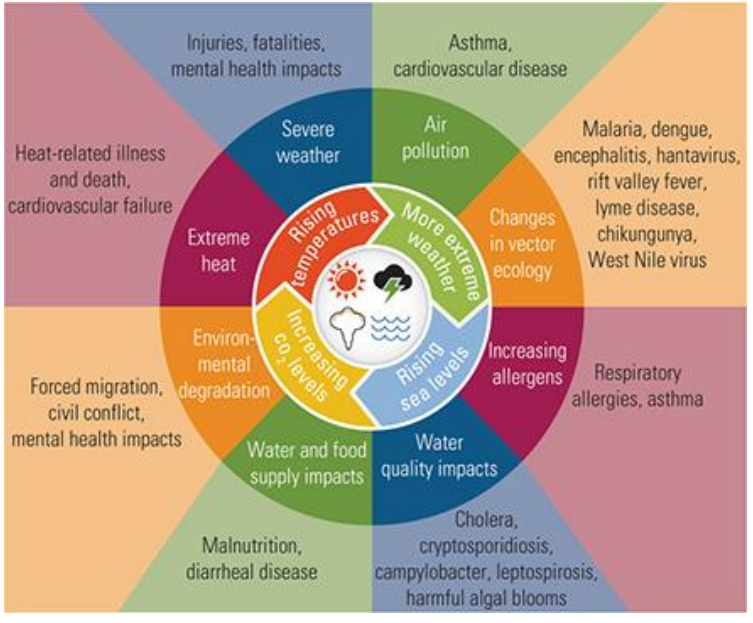
- **It is now demonstrated the non-market ecosystem service values associated with a range of ecosystems and also how these values can be estimated for ecosystem service benefits associated with ecosystem types that are often not that familiar to citizens.**
- The European Green Deal and the EU Biodiversity Strategy 2030 headline objectives place a strong emphasis on the **importance of biodiversity for human wellbeing and development**.
- The contribution of marine ecosystems to societal welfare is often however not properly accounted for as many of the transactions involved are non-market in nature.

ONE HEALTH APPROACH

protect Humans protecting Nature

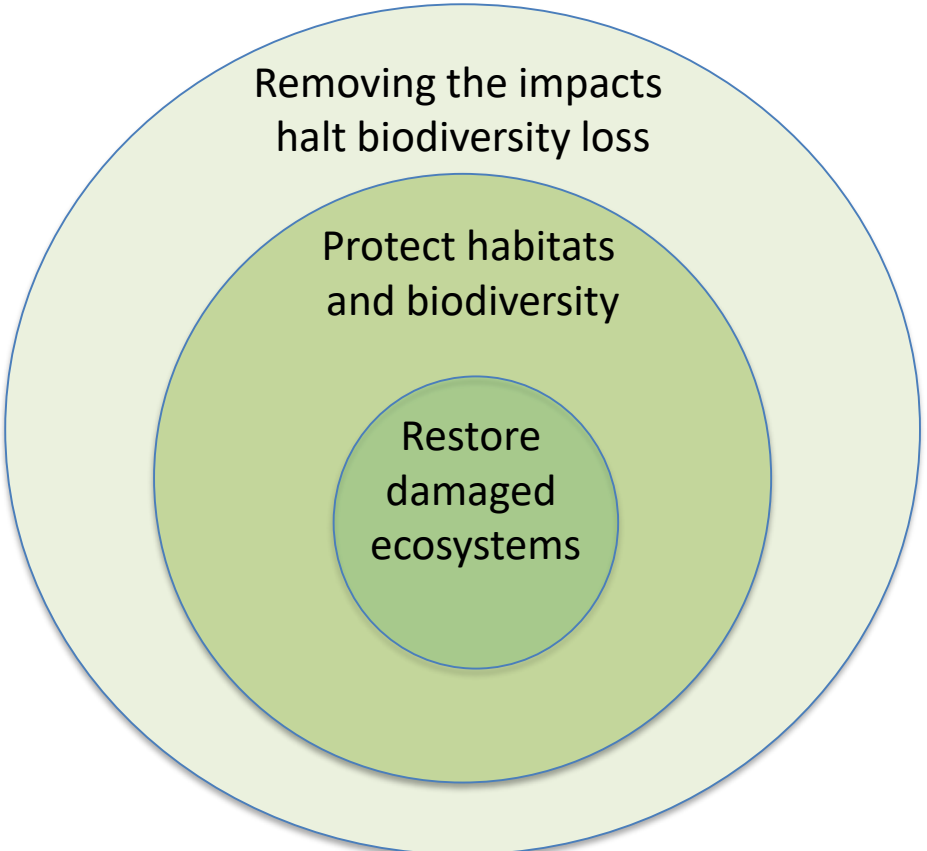
The One Health concept is a worldwide strategy for expanding interdisciplinary collaborations and communications in all aspects of health care for humans, animals and the environment.





"Human or livestock or wildlife health can't be discussed in isolation anymore. There is just one health. And the solutions require everyone working together on all the different levels."

Solutions?



1 Achieving climate and biodiversity protection together 6

2 Strengthening planetary health 10

3 Considering hidden biodiversity 14

4 Promoting biocultural habitats 18

5 Using forests sustainably 21

6 Transforming agriculture 25

7 Protecting land and resources 28

8 Expanding transnational infrastructures and education for sustainability 32

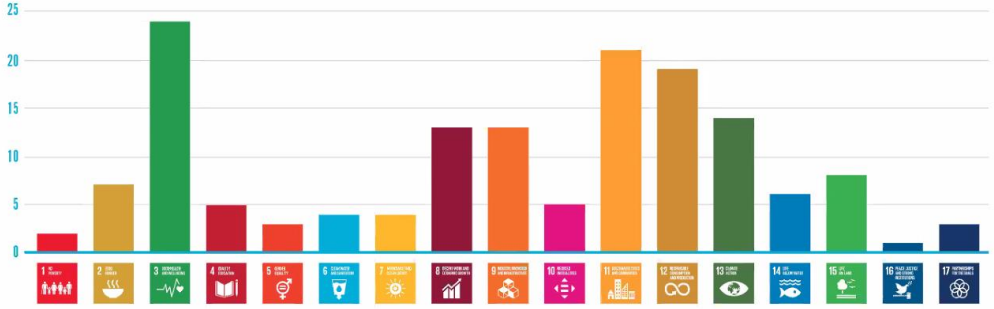
9 Ensuring access and open use of research data 36

10 Setting biodiversity-friendly incentives 40

Biodiversity Strategy 2030

GOAL 14 - CONSERVE AND SUSTAINABLY USE THE OCEANS, SEAS AND MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT

GOAL 15 - PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS



Number of AI projects addressing each SDG. Cowl, Tsmados, Taddeo, Floridi, Nature M achine Intelligence2020

BIODIVERSITY AND THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

Convention on Biological Diversity
Food and Agriculture Organization of the United Nations
THE WORLD BANK
UNEP
UNDP

European Commission

EU BIODIVERSITY STRATEGY

Bringing nature back into our lives

"Making nature healthy again is key to our physical and mental wellbeing and is an ally in the fight against climate change and disease outbreaks. It is at the heart of our growth strategy, the European Green Deal, and is part of a European recovery that gives more back to the planet than it takes away."

Ursula Von der Leyen, President of the European Commission

Global challenges like **climate change**, the unprecedented **loss of biodiversity**, and the spread of devastating **pandemics** are sending a clear message: it's time to **fix our broken relationship with nature**.

- As the world emerges from the COVID-19 crisis, it's more important than ever to build a more **resilient** society. **The post-2020 global biodiversity framework** will play a vital role in creating a more **sustainable future.**

The **2030 Biodiversity Strategy** will put Europe's biodiversity on the path to recovery by 2030, for the benefit of people, climate and the planet.

It will also prepare the EU to take a leading role in the upcoming international negotiations on a new global framework to halt biodiversity loss.

As a core part of the **European Green Deal**, it will support recovery in a post-pandemic world, bringing jobs and sustainable growth.

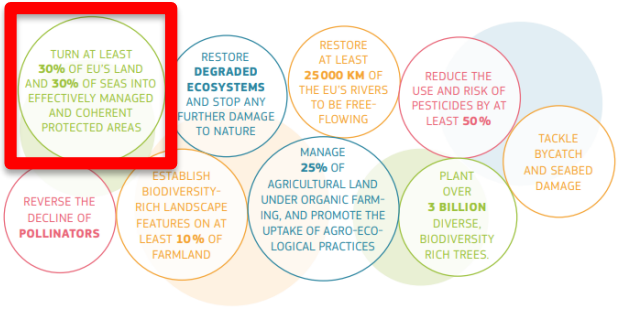
BIODIVERSITY is the variety of life on Earth, including plants, animals, fungi, micro-organisms, and the habitats in which they live. This web of living things forms the ecosystems that underpin all economies and societies.

Environment

Restore and protect

The **2030 Biodiversity Strategy** builds upon and goes beyond the existing EU Birds and Habitats Directives and the EU Natura 2000 Network of protected areas.

IT SETS AMBITIOUS EU TARGETS AND COMMITMENTS FOR 2030 TO ACHIEVE HEALTHY AND RESILIENT ECOSYSTEMS, FOR EXAMPLE:



This **transformational systemic change** will engage all parts and sectors of European society and the economy. At least **EUR 20 billion a year** will be unlocked for nature, encouraging businesses, publ authorities, cities and local authorities to include biodiversity concerns in their decision-making.

This is Europe's opportunity to lead the way and help the world to adopt a **robust global framework** to halt biodiversity loss when negotiations take place in 2021 under the **UN Convention on Biological Diversity.**

The Strategy outlines what the EU aims to achieve and is ready to commit to at the **2021 UN Biodiversity Conference, including:**

- Overarching long-term goals for biodiversity ensuring that by 2050 all of the world's ecosystems are restored, resilient, and adequately protected
- Ambitious global 2030 targets in line with the EU commitments proposed in the new Biodiversity Strategy
- Improved means of implementation in areas such as finance, capacity, research, know-how and technology
- A far stronger implementation, monitoring and review process
- A fair and equitable share of the benefits from the use of genetic resources linked to biodiversity and a principle of equality.

The Strategy also sets out ambitious measures in the sphere of EU external action through the EU's 'Green Deal diplomacy', including in international ocean governance, trade, development co-operation, neighbourhood policies and resource mobilisation.

European Commission

The business case for biodiversity

The European Green Deal

May 2020
#EUGreenDeal

More than half of global GDP – some €40 trillion – depends on nature

Nature restoration will be a central element of the EU's recovery plan from the coronavirus pandemic, providing immediate business and investment opportunities for restoring the EU's economy.

These sectors are all highly dependent on nature, and they generate **more than €7 trillion**.

The **benefits** of biodiversity conservation for the economy:

- ✓ conserving marine stocks could increase annual profits of the seafood industry by more than **€49 billion**
- ✓ protecting coastal wetlands could save the insurance industry around **€50 billion annually** through reducing flood damage losses

Six industries:

Chemicals and materials | Aviation, travel and tourism | Real estate | Mining and metals | Supply chain and transport | Retail, consumer goods and lifestyle

Depend through their supply chain on nature for more than 50% for their gross value added.

Benefits of the **EU Natura 2000 nature protection network** are valued at between **€200-300 billion** per year.

Economic and social costs of inaction

Biodiversity loss and ecosystem collapse is one of the biggest threats facing humanity in the next decade. **Economic and social costs of inaction** would be huge. The world already lost an estimated €3.5-18.5 trillion per year in ecosystem services from 1997 to 2011, and an estimated €5.5-10.5 trillion per year from land degradation. Biodiversity underpins EU and global food security. Biodiversity loss risks puts our food systems and nutrition at risk.

Biodiversity loss is intrinsically linked to and exacerbates climate change.

Biodiversity loss results in reduced crop yields and fish catches, increased economic losses from flooding and other disasters, and the loss of potential new sources of medicine.

More than **75% of global food** crop types rely on animal pollination.

On average, global mean crop yields of rice, maize and wheat are projected to decrease **between 3% and 10% per degree** of warming above historical levels.

Creating jobs

Nature Restoration means direct and indirect local jobs that bring life back to local communities.

The Natura 2000 network has been estimated to **support 104,000 direct jobs** in protected areas management and conservation activities and 70,000 more indirect or induced jobs. This is based on annual investment of €6 billion for management and restoration of the network.

In the future, it is expected that biodiversity needs could generate up to **500,000 jobs.**

For **agriculture**, 1.3 million of the 9.6 million farming jobs in the EU are linked directly or indirectly to Natura 2000. **The tourism sector** employs 12 million people in Europe. Of these, 3.1 million have links to protected areas such as Natura 2000.

Of the 25% of the EU budget dedicated to **climate action**, a significant proportion will be invested in biodiversity and nature-based solutions.

Ecological transition: what to do to contrast biodiversity loss?

Main points to tackle:

Habitat and biodiversity loss: increasing protection and promoting ecosystem restoration.

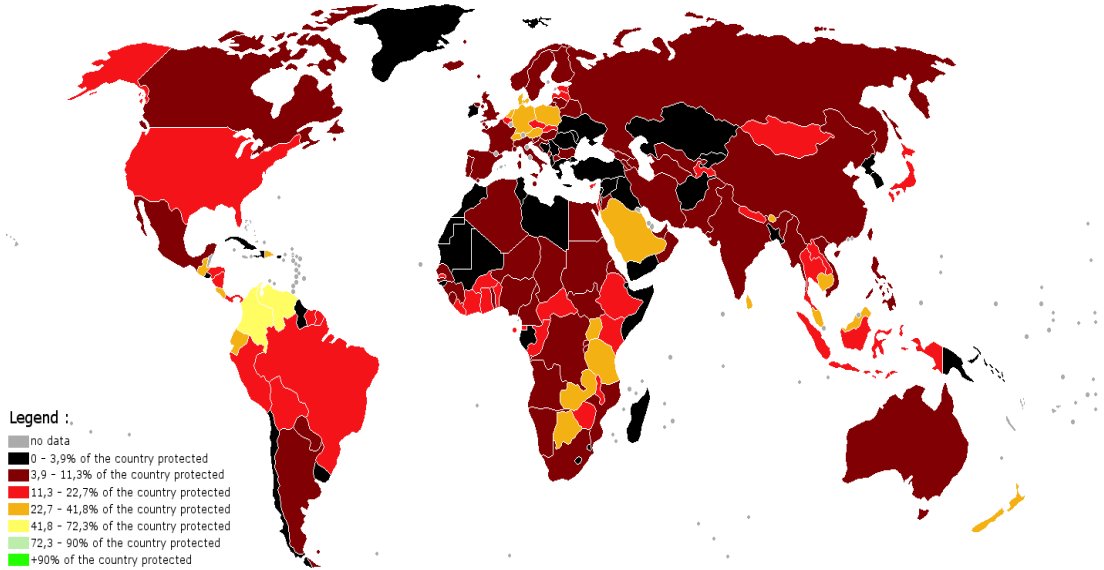
Unsustainable use of biotic resources: finding innovative solutions for food production – Circular economy – reducing waste

Global climate change: reduced CO2 and other climate-altering gases

Altered global biogeochemical cycles: finding innovative and sustainable solutions for agriculture and zootechnics

Pollution: do not use, produce and consume the products that have environmental impacts

Investing in Natural Capital



We need to invest in Nature *protection to preserve and increase biodiversity, recover degraded environments and refurnish again human populations of ecosystem services at large spatial scales*

Advanced economies, such as Europe, US, Australia and Canada are seeing a **improvement of environmental conditions. BUT not in terms of biodiversity or abundance of threatened species**. Developed Countries are promoting environmental protection through a progressive legislation and dedicated policies.

Measures to enhance our Natural Capital

AP1. Rehabilitation and restoration of ecosystems: (coastal, rivers and inland wetlands evaluated in the List Red as highly vulnerable ecosystems. Woods and forests in the most populated areas, marine environments

AP2. Ecological requalification of the agricultural system e intensive livestock farming: 60 million trees to replenish the essential forest elements of natural vegetation Ecological network to mitigate the effects of the "ecological desert".

AP3. Natura 2000 and new protected areas: Increase of protected areas (European Biodiversity Strategy of 30% of protected territory and 10% of fully protected territory)

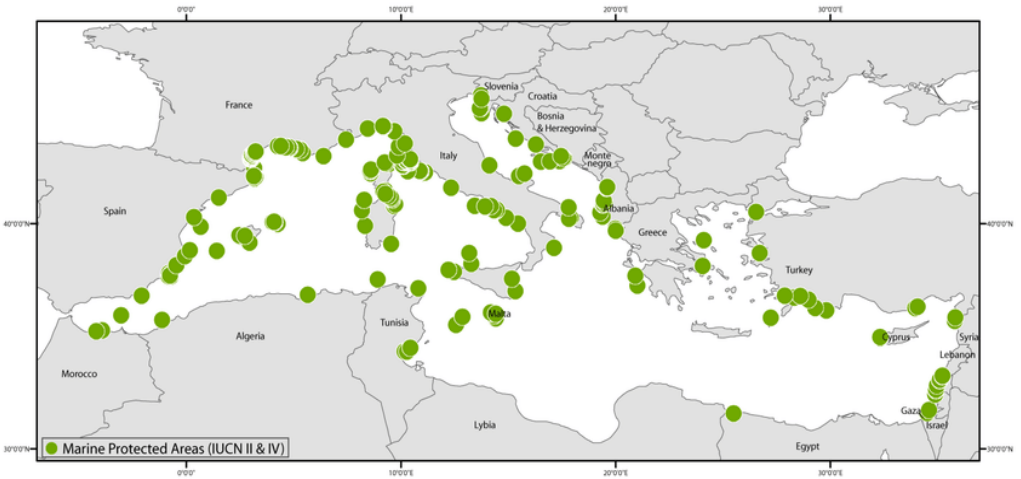
AP4. Urban forestry (resilient cities and citizens' health): “Urban and peri-urban forests starting from metropolitan cities and cities with more than 50,000 inhabitants. Reduce pollution (air, water, soil).

AP5. Monitoring of Biodiversity and Natural Capital: Monitoring of natural capital to quantify and enhance the role of Protected Areas and Natura 2000 sites.

How far we are? Protect our (marine) Biodiversity

- MPA coverage is making progress in the Mediterranean
- There are **1,215 MPAs and OECMs** in the Mediterranean covering 171,362 km^2 **which places a surface of 6.8% under a legal designation**.
- These sites present a great variety of conservation designations.
- National designations account for only 1.27% and no-go, no-take or no-fishing zones for 0.04%.

For the majority of sites,
little is known about the management measures in place and if they are effective at maintaining or restoring the biodiversity they aim to protect.



2021-2030: UN Decade on Ecosystem Restoration
"Reversing habitat loss"

This call to action has the purpose of recognizing the need to massively accelerate global restoration of degraded ecosystems, to fight the climate heating crisis, enhance food security, provide clean water and protect biodiversity on the planet.

Only with healthy ecosystems can we enhance people's livelihoods, counteract climate change, and stop the collapse of biodiversity.

This decade is an opportunity to help turn the tide and give people and nature a sustainable future.

UNITED NATIONS DECADE ON
ECOSYSTEM
RESTORATION
2021-2030

Technologies for an ecological transition

"*Technology is a powerful tool, capable of changing natural systems*" either in the negative and also in the positive sense.

So far we have used technology and knowledge almost exclusively to "consume" (faster) the Planet. But we can (we must) direct our knowledge and available technologies for positive targets for Nature.

Using technology with its potential as "**intelligent solutions**", to recover the planet, restore balance to the functioning of ecosystems, recover the loss of biodiversity.

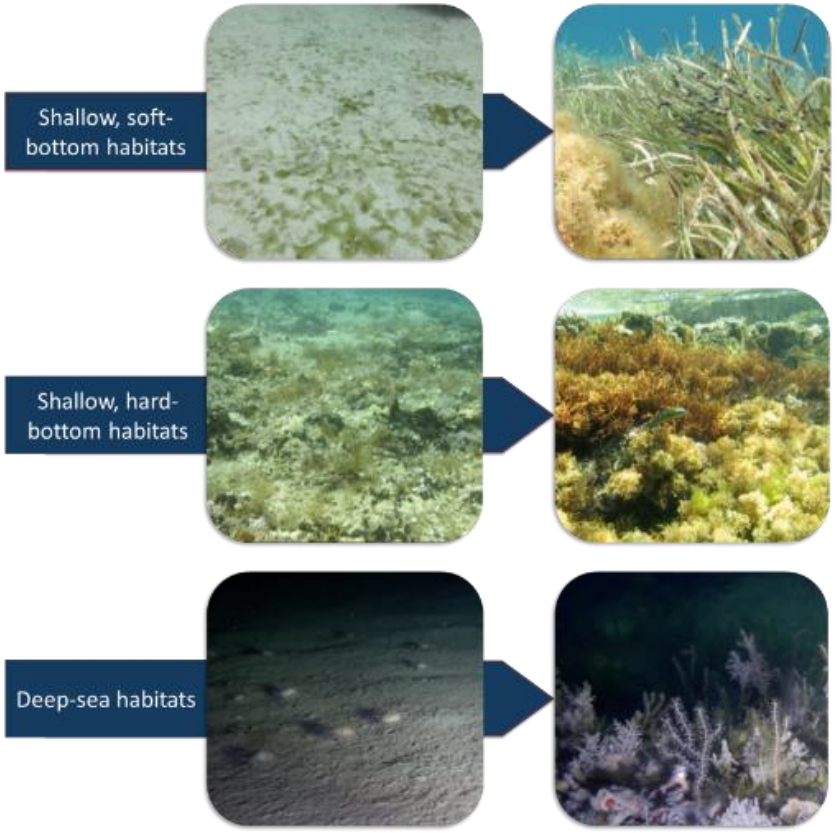
Marine Ecosystem Restoration

Learning Lessons from the Great Experience of the Ecological restoration in Terrestrial Ecosystems

Making restoration a long-term success

Using the best (innovative) technologies for “fix” what human have destroyed or damaged in the Anthropocene

Creating new job and new employment



1. Mapping habitat degradation and identifying the current stressors

frontiers in Marine Science

ORIGINAL RESEAR
published: 04 October 2
doi: 10.3389/fmars.2021.658

Effects of Natural and Anthropogenic Stressors on Fucalean Brown Seaweeds Across Different Spatial Scales in the Mediterranean Sea

Sotiris Orfanidis[1], Fabio Rindi[2], Emma Cebrian[3,4], Simonetta Fraschetti[5,6], Ina Nasto[7], Ergun Taskin[8], Silvia Bianchelli[2], Vasileios Papathanasiou[1], Maria Kosmidou[1], Annalisa Caragnano[2], Soultana Tsioli[1], Stefano Ratti[2], Erika Fabbrizzi[5,6], Jana Verdura[3,4], Laura Tamburello[5], Sajmir Beqiraj[7], Lefter Kashta[7], Denada Sota[7], Apostolos Papadimitriou[1], Ezzeddine Mahmoudi[9], Hajdar Kiçaj[7], Konstantinos Georgiadis[1], Amel Hannachi[9] and Roberto Danovaro[2,5]*

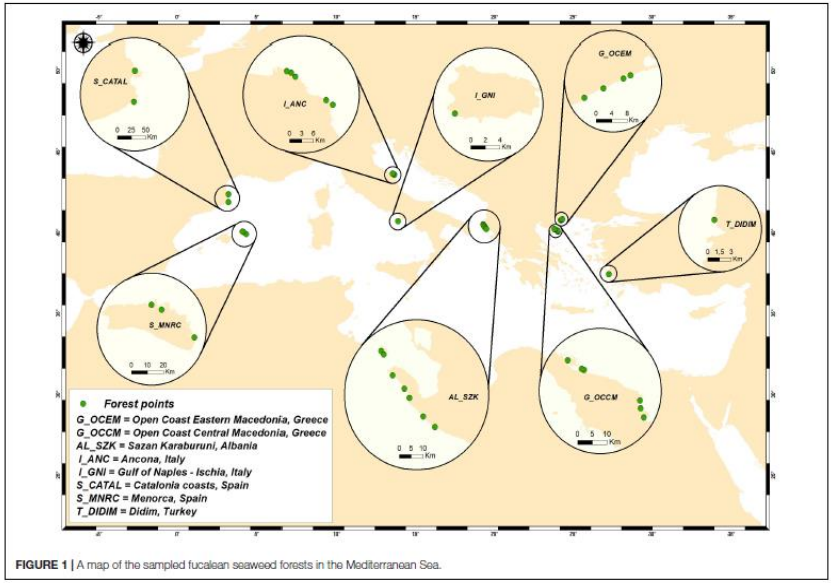


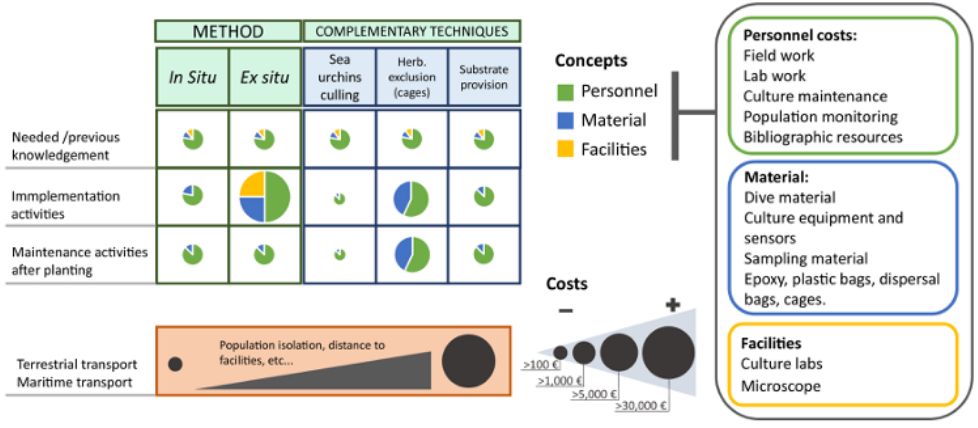
FIGURE 1 | A map of the sampled fucalean seaweed forests in the Mediterranean Sea.

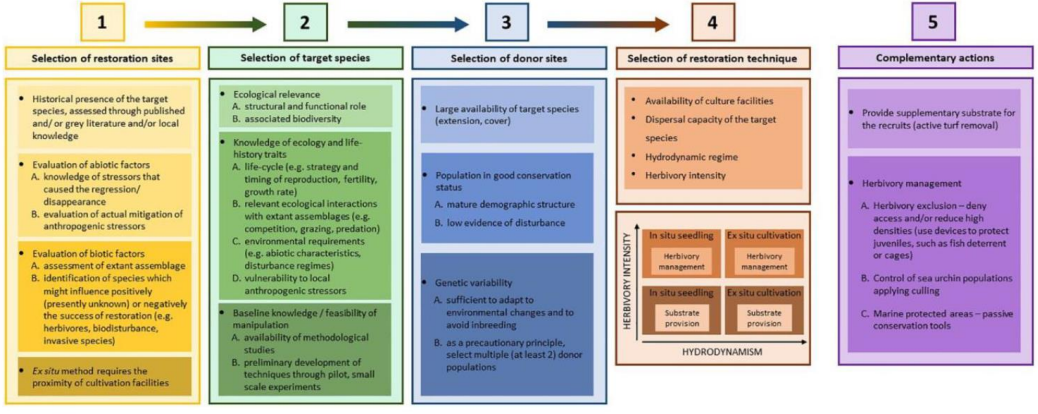
Where are climate refugia?

Which are the priority areas for restoration?

Where is possible to carry on marine ecosystem restoration?

2. Marine Ecosystem Restoration: looking for protocols





frontiers in Marine Science

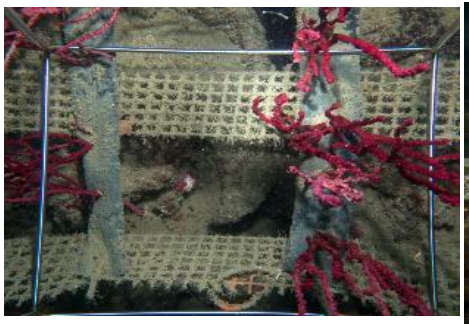
REVIEW
published: 15 October 2021
doi: 10.3389/fmars.2021.709219

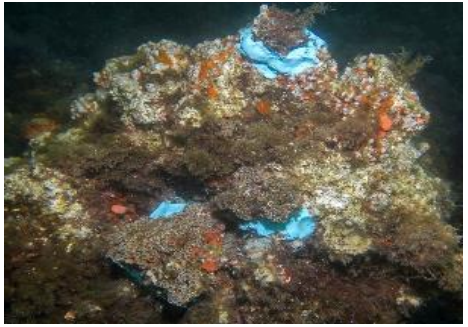
A Roadmap for the Restoration of Mediterranean Macroalgal Forests

Emma Cebrian[1], Laura Tamburello[2], Jana Verdura[1], Giuseppe Guarnieri[3,4], Alba Medrano[5], Cristina Linares[5], Bernat Hereu[5], Joaquim Garrabou[6], Carlo Cerrano[7], Cristina Galobart[1] and Simonetta Fraschetti[2,4,8]*

3. Measuring the success of marine ecosystems restoration

- assess ecological benefits of cost-effective restoration actions.
- protocols and indicators of success
- applicability across regions
- effectiveness under a changing ocean

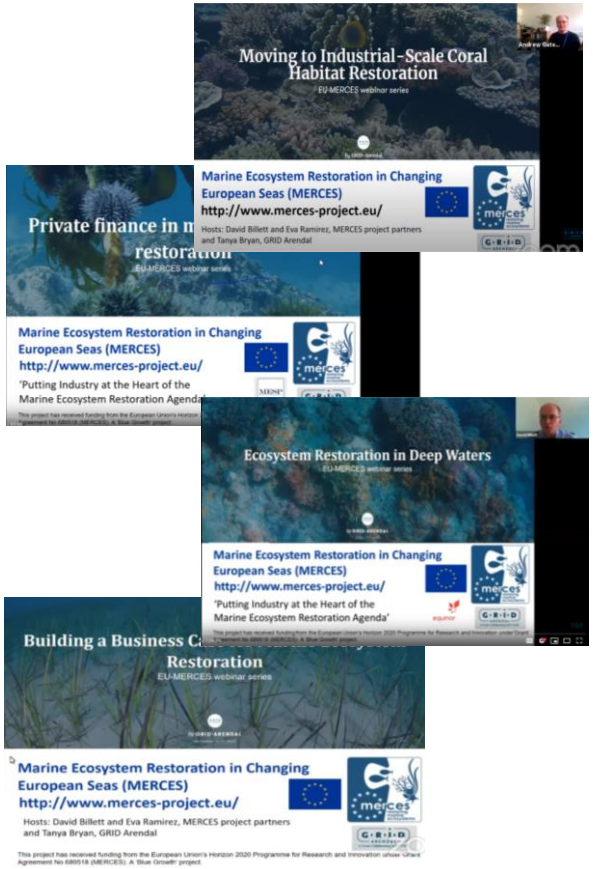




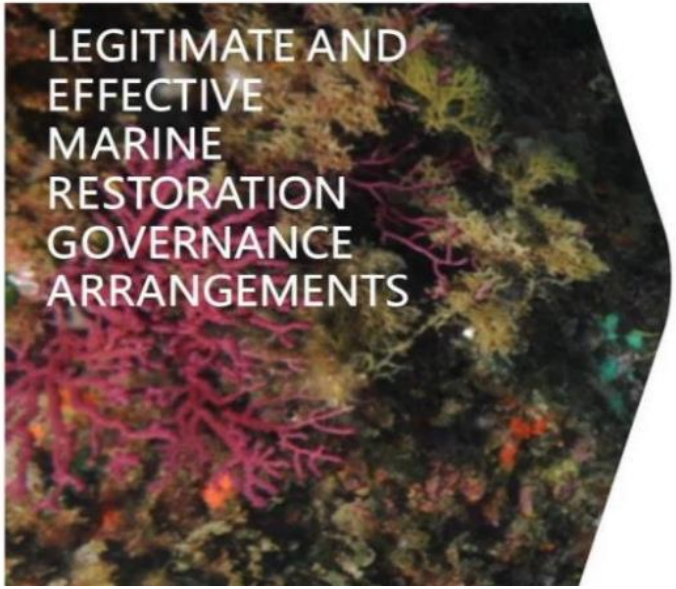
4. Making marine ecosystem restoration a Societal Driver

Increasing number of private companies interested in orienting their business to marine ecosystem restoration:

members from coastal zone management; flood defense, ports and harbors, civil and coastal engineering, decommissioning of oil rigs, offshore oil and gas, oil spill response and clean up, fisheries, aquaculture, offshore energy, organizations promoting ecotourism, dredging, deep-sea mining, shipping, law partnerships, suppliers of monitoring technologies and services, local and regional authorities, applied research institutions, regional seas organizations, Government Departments for the environment, conservation and nature, Government Agencies, technology transfer offices, environmental NGOs, marine environmental consultancies.



5. Marine Restoration Policy, Governance and Arrangements



A linkage between the top-down and the bottom-up restoration governance arrangements is lacking.

To fill this implementation gap, a process of institutionalization of restoration governance arrangements at different levels needs to take place

- ✓ Understand the constraining factors of the legal and governance context
- ✓ Development and design of legitimate governance
- ✓ Planning effective legal regimes

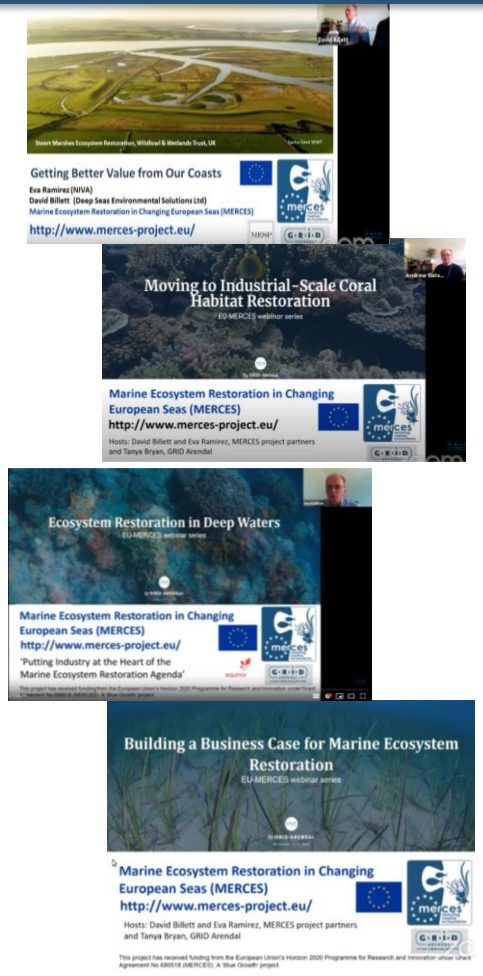
The Restoration Business

Making restoration a business for the EU Green Deal

Industrial sectors

Tourism and coastal zone management; flood defense, ports and harbours, civil and coastal engineering, decommissioning, offshore oil and gas, oil spill response and clean up, fisheries, aquaculture, offshore energy, ecotourism, dredging, deep-sea mining, shipping, law partnerships, suppliers of monitoring technologies and services, local and regional authorities, applied research institutions, regional seas organizations, Government Departments for the environment, conservation and nature, Government Agencies, technology transfer offices, environmental NGOs, marine environmental consultancies.

PSBE: Partnership Sustainable Blue Economy



Ecosystem Restoration: a long process

EU COASTS: 68 000 km long (25% degraded?)

17 trillion Euros for restoring the coastlines

Italy:

8700 km ca 30% damaged
ca 26.000 ha
30-260 billion Euros

Environmental impact assessment

Need of compensate (ecologicala restoration) for any, even minor, impact caused by any new infrastructure

Ecosystem	Overall restored area (ha)*	Duration of the project (yr)*
coral reefs	ca 4	1 - 12
seagrass	ca 18	0.7 - 3
mangroves	ca 40000	0.8 - 21
salmarshes	ca 2	2 - 3
oyster reefs	ca (?)	<9
coral reefs	ca 14	0.2 - 13
seagrass	ca 3500	3 - 32
mangroves	ca 208000	10 - 32
salmarshes	ca 12451	0.2 - 13
oyster reefs	ca 225	1 - 14
kelp	ca 3500	4 - 9

What we need for ecosystem restoration:

- **Coordinating policies & practice** - Increased coordination of national, European and international policy
- **Provide long-term funding** - Restoration is a long-term process that requires sustainable financing to be successful.
- **Innovative funding and cross-sectoral collaborations** are urgently needed
- **Prioritization and Upscaling** - In order to meet ambitious goals and targets, marine ecosystem restoration must be upscaled.
- **Research and communication** - Better understanding and communication of ecosystem service recovery and thresholds in needed.
- **Tackling the root of the problem** - Restoration should be paired with supportive management practices to reduce pressures and habitat damage.
- **Collaborations for change** - increased social awareness and greater collaboration between marine, terrestrial and freshwater restoration efforts.

The Costs of Inaction

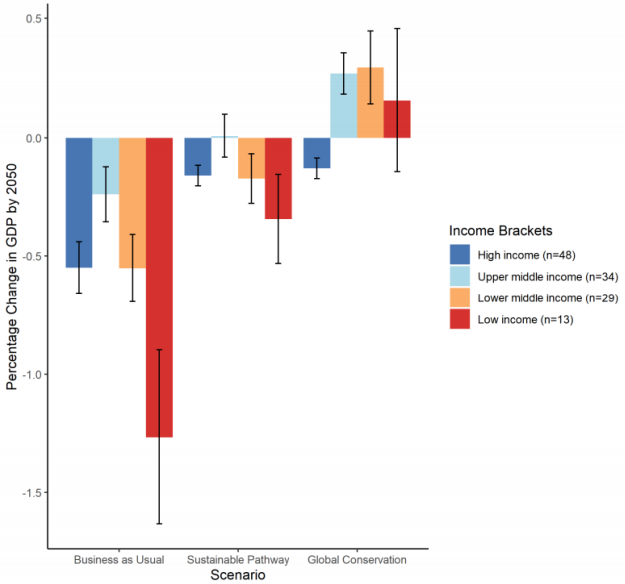
Is there a cost for the loss species? It looks that we care only for the species we use, we sell.

The economic costs of inaction on our climate and ecological crises has been estimated in **US$9.87 trillion in GDP by 2050** (loss in timber production, coastal protection, fisheries, agricultural pollination, water supply and carbon storage in only 140 countries WWF Report).
This is a deeply conservative estimate based on the analys services.

The 'Business-as-Usual' scenario has greatest economic c with the U.S., Japan and the UK economies facing losses c **US$83, $80 and $21 billion every year**, respectively.

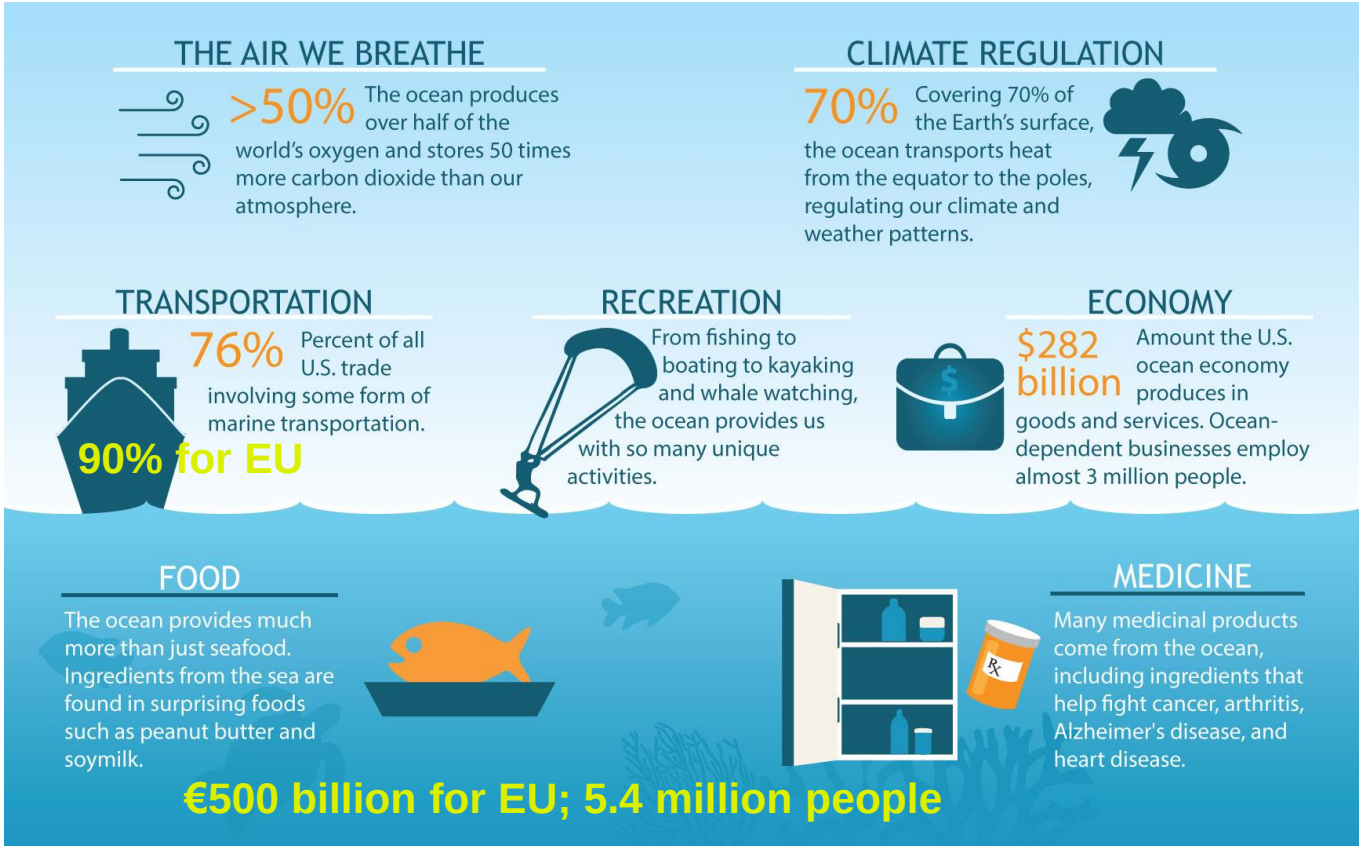
The 'Sustainable Pathway', based on the realization of curr sustainability ambition, results in a US$129 billion loss in gl GDP per year by 2050.

GDP loss (as %GDP) will be greatest in developing countri

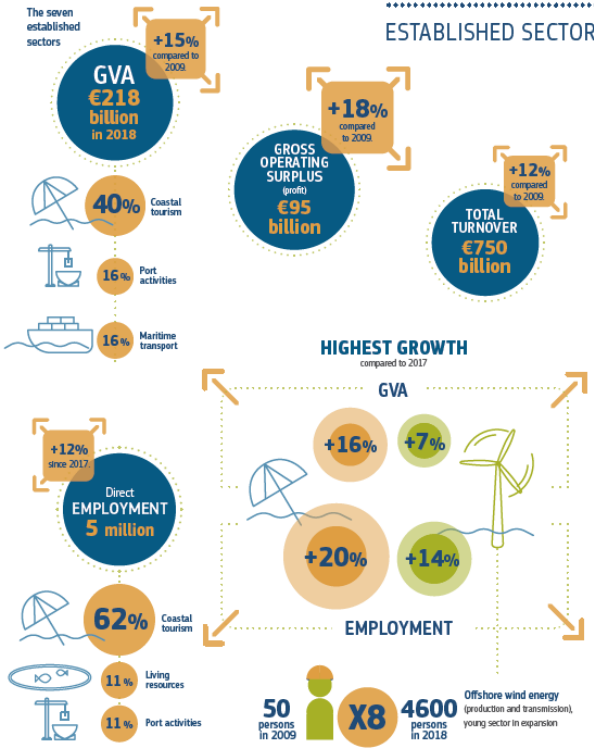


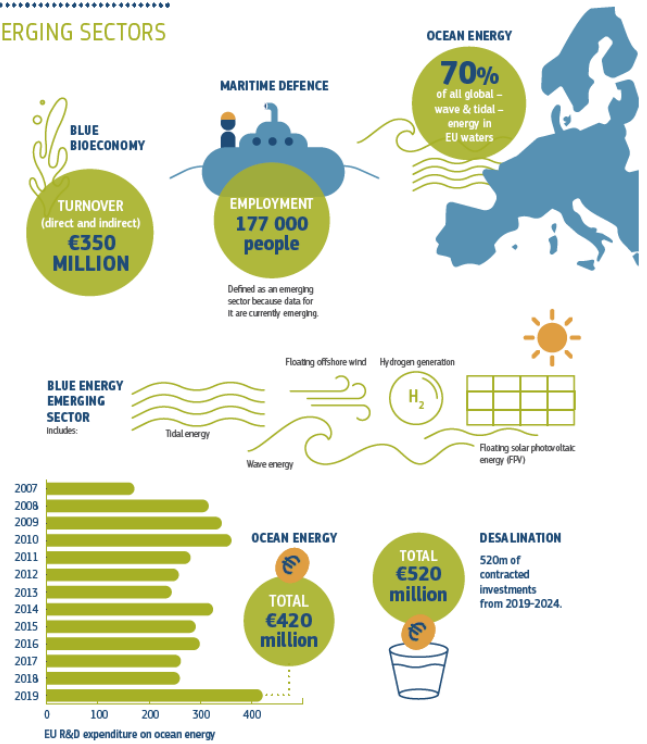
The contribution of ecology to the Blue Ecological Transition

The potential of the blue economy



The EU Blue Economy





The Green-Blue Revolution

"*The technological revolution must be GREEN and BLUE to face the Great Crisis*".

Technology has allowed us to live well up to a certain point, beyond which the unsustainability (economic, environmental and social) produced by the technology itself, prevent us from continuing along the path of quantitative growth.

Since resources are limited in a "closed" world, like our planet, we need research that is able to direct innovations towards:

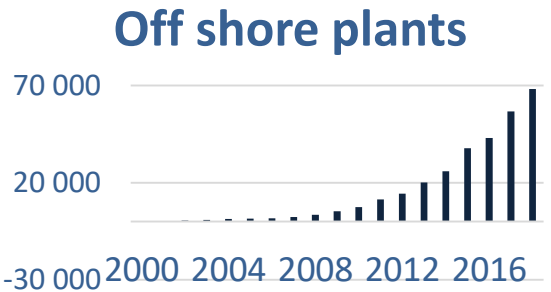
- **Technologies that save energy and raw materials.**
- **Technologies for the production of renewable energy**
- **Technologies for CO2 sequestration and climate-altering gases**
- **Technologies for waste treatment and recycling**
- **Eco-technologies for sea water desalination**
- **Technologies for green infrastructures**
- **Technologies for ecological restoration**
- ***(Restoration Economy)***

Sustainable food and renewable energy

FOOD - Land expansion increases climate change and biodiversity loss. Eco-sustainable mariculture could fill the gap.

RENEWAL ENERGIES - The expansion of wind power to the ground is increasingly difficult. Floating offshore plants are the sustainable future of renewable energy (2 GW plants)

ABIOTIC RESOURCES (HYDROCARBONS AND MINERALS)
Abyss source of enormous hydrocarbon resources (> 50% of the planet) - Polymetallic nodules (significant impacts)



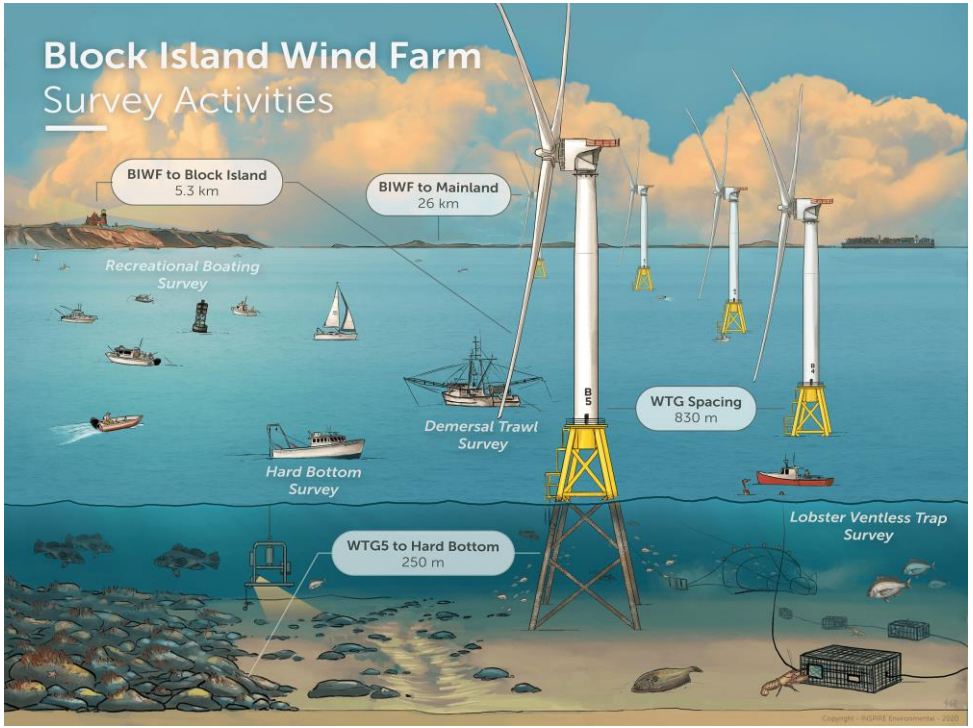
The role of EIA

DNSH – What do we mean by
"**Do no significant harm**" ?

EIA for RENEWAL ENERGIES - OWF

EIA for ABIOTIC RESOURCES (hydrocarbons and minerals)
Is there an ecosystem-based approach?

MSP
Habitat mapping as a fundamental tool for MSP



OECM: Other Effective areas-based conservation measures - coupling Renewable energy production with environmental protection

Recommendations for a **real** blue ecological transition

- Using marine space for the production of renewable resources
- Stopping progressively the use of fossil fuels (starting from oil)
- Coupling offshore wind and solar farms with marine protected areas / fishery restricted areas
- Exploiting the potential of eco-sustainable approaches and nature-based solutions
- Converting the fisheries into integrated aquaculture plants
- Using the deep-sea exhausted wells for carbon storage
- Developing eco-sustainable technologies to reduce the impact of economic activities at sea
- Developing a national and international plan for biosphere restoration

grazie